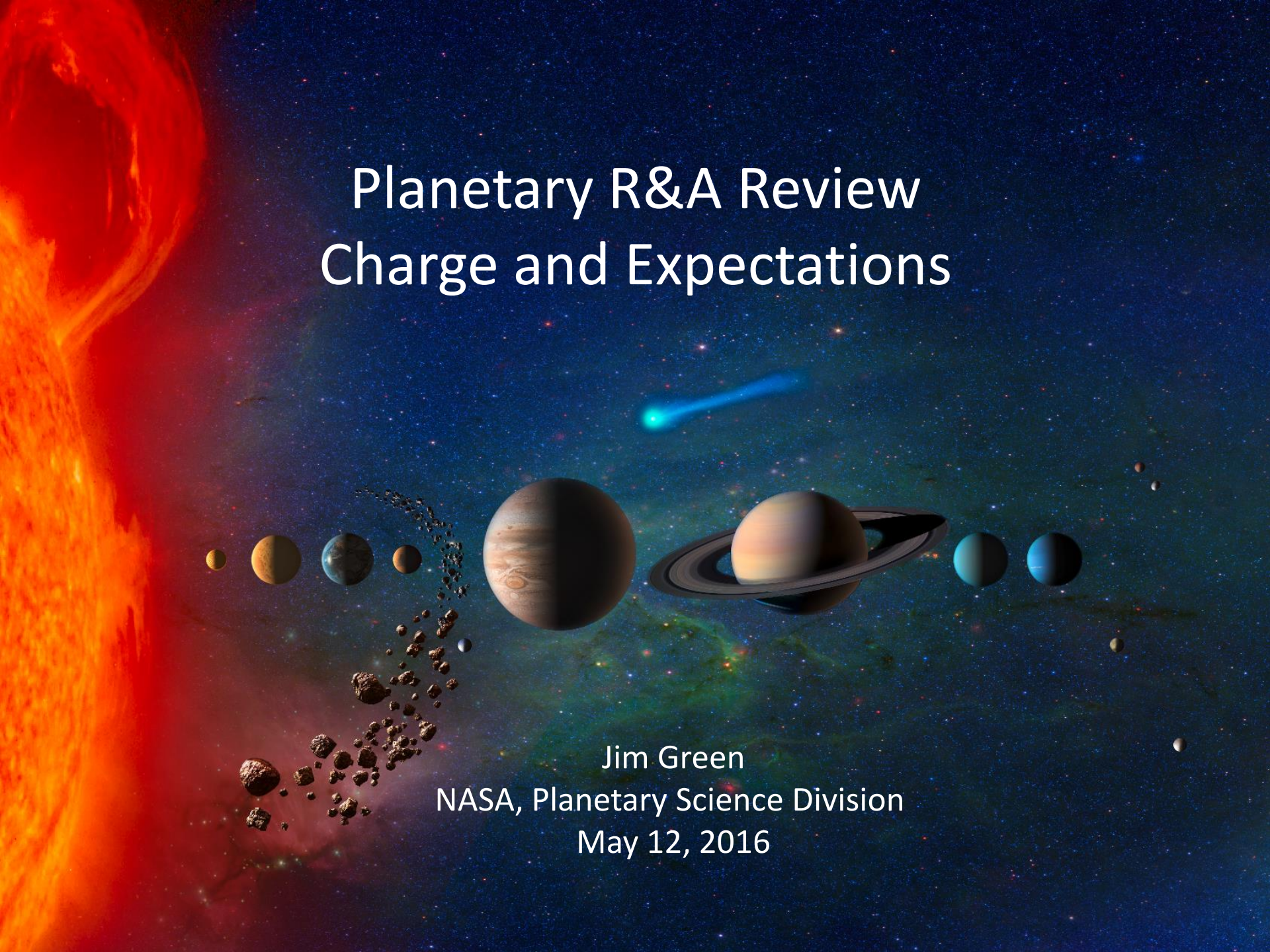
Planetary R&A Review
Charge and Expectations



Jim Green
NASA, Planetary Science Division
May 12, 2016

Background

Why restructure the Research & Analysis (R&A) program ?

- R&A program has been around since the beginning of NASA
  - First award was in 1959
- More program elements were added over time without replacing older elements
- Some program elements had accreted requirements that have since gone obsolete but never ended
- Over time the existing R&A program was getting harder to evaluate since our metrics are tied to our strategic plan
- As we enter into a new era of cross-discipline and planetary science we need a new framework of program elements
- NRC report: An Enabling Foundation for NASA's Earth and Space Science Missions (aka: Fisk Report) recommended an explicit connection between the R&A program elements and NASA strategic plan

Charge: National Academy R&A Study

Objective: Examine the program elements of the PSD R&A programs, as they currently exist following restructuring, for their consistency with past NRC advice.

The committee will address the following questions:

1. Are the PSD R&A program elements appropriately linked to, and do they encompass the range and scope of activities needed to support, the NASA Strategic Objective for Planetary Science and the PSD Science Goals, as articulated in the 2014 *NASA Science Plan*?

2. Are the PSD R&A program elements appropriately structured to develop the broad base of knowledge and broad range of activities needed both to enable new spaceflight missions and to interpret and maximize the scientific return from existing missions?

NASA's Strategic Objectives

Strategic Goal	Strategic Objective	MD/Office	Contributing Programs
1: Expand the frontiers of knowledge, capability, and opportunity in space.	1.1 - Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and international collaboration.	HEOMD	Orion Multi-Purpose Crew Vehicle Program, Space Launch System Program, Exploration Ground Systems Program, and Advanced Exploration Systems
	1.2 - Conduct research on the International Space Station (ISS) to enable future space exploration, facilitate a commercial space economy, and advance the fundamental biological and physical sciences for the benefit of humanity.	HEOMD	International Space Station Program, Human Research Program, and Human Space Flight Operations Program
	1.3 - Facilitate and utilize U.S. commercial capabilities to deliver cargo and crew to space.	HEOMD	Commercial Crew Program
	1.4 - Understand the Sun and its interactions with Earth and the solar system, including space weather.	SMD	Heliophysics Research Program, Living with a Star Program, Solar Terrestrial Probes Program, and Heliophysics Explorer Program
	1.5 - Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.	**SMD**	**Planetary Science Research Program, Lunar Quest Program, Discovery Program, New Frontiers Program and Mars Exploration Program, Outer Planets Program, Planetary Technology Program**
	1.6 - Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars.	SMD	Astrophysics Research Program, Cosmic Origins Program, Physics of the Cosmos Program, Exoplanet Exploration Program, Astrophysics Explorer Program, James Webb Space Telescope Program
	1.7 - Transform NASA missions and advance the Nation's capabilities by maturing crosscutting and innovative space technologies.	STMD	Space Technology Research and Development (STRD), Small Business Innovation Research / Small Business Technology Transfer (SBIR/STTR)
2: Advance understanding of Earth and develop technologies to improve the quality of life on our home planet	2.1 - Enable a revolutionary transformation for safe and sustainable U.S. and global aviation by advancing aeronautics research.	ARMD	Airspace Operations and Safety Program, Advanced Air Vehicles Program, Integrated Aviation Systems, Transformative Aeronautics Concepts Program
	2.2 - Advance knowledge of Eart … of environmental change, a…		…h Systemic Missions Program, Earth System …ence Multi-Mission Operations Program and …ciences Program
	2.3 - Optimize Agency techn… innovation, and facilitate technology infusion, ensuring the greatest National benefit	OCT	Agency Technology and Innovation
	2.4 - Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers and faculty in NASA's missions and unique assets.	Education	Aerospace Research & Career Development Program, STEM Education and Accountability Program
3: Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.	3.1 - Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.	MSD	Center Management and Operations, Agency Management, Institutional Construction of Facilities, Environmental Compliance and Restoration
	3.2 - Ensure the availability and continued advance of strategic technical programmatic capabilities to sustain NASA's Mission.	HEOMD	Space Communications and Navigation Program, 21st Century, Launch Services Program, Rocket Propulsion Testing Program, Programmatic Construction of Facilities Program, Strategic Capabilities Assets Program
	3.3 - Provide secure, effective, and affordable information technologies and services that enable NASA's Mission.	OCIO	Agency IT Services Program
	3.4 - Ensure effective management of NASA programs and operations to complete the mission safely and successfully.	OCE, OSMA, OCHMO	Program elements consist of work managed by OCE, OSMA, and OCHMO

A New SMD Science Plan must be completed
Within 1 year after a new Administration

SMD 2014 Science Plan

Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

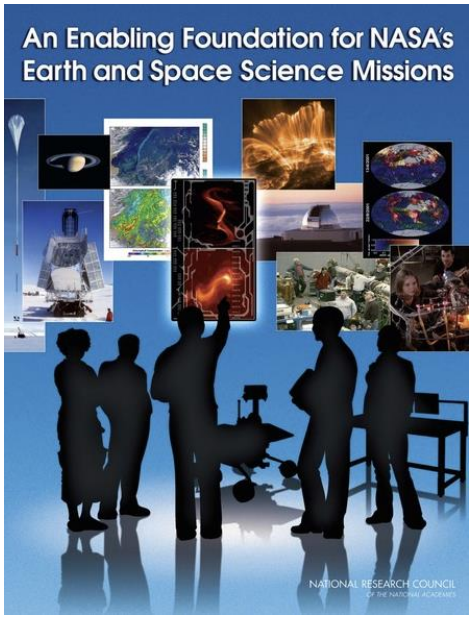
- Explore and observe the objects in the solar system to understand how they formed and evolve.
- Advance the understanding of how the chemical and physical processes in our solar system operate, interact and evolve.
- Explore and find locations where life could have existed or could exist today.
- Improve our understanding of the origin and evolution of life on Earth to guide our search for life elsewhere.
- Identify and characterize objects in the solar system that pose threats to Earth, or offer resources for human exploration.

http://science.nasa.gov/media/medialibrary/2014/05/02/2014_Science_Plan-0501_tagged.pdf

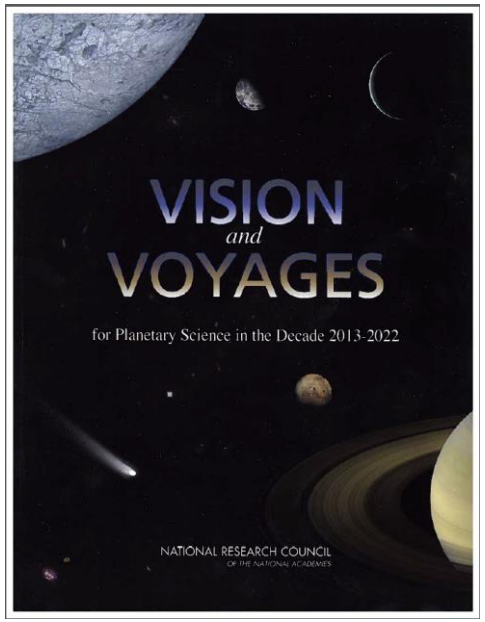
Resulting Program Evolution

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Cosmochemistry										
Planetary Geology and Geophysics										
Planetary Astronomy										
Planetary Atmospheres										
Near Earth Object Observations										
Origins of Solar Systems										
Outer Planets Research										
Mars Fundamental Research										
Astrobiology: Exobiology and Evolutionary Biology										
Lunar Advanced Sci & Expl. Research (with HEO)										
Mars Data Analysis										
Cassini Data Analysis										
Jupiter Data Analysis (NH, Voyager, Galileo)										
Planetary Mission Data Analysis										
Discovery Data Analysis										
Sample Return Laboratory Instruments & DA										
Laboratory Analysis of Returned Samples										
Lunar Data Analysis										
Emerging Worlds										
Solar System Workings										
Habitable Worlds										
Exobiology										
Solar System Observations										
Planetary Data Archiving, Restoration, and Tools										
Exoplanets Research Program										

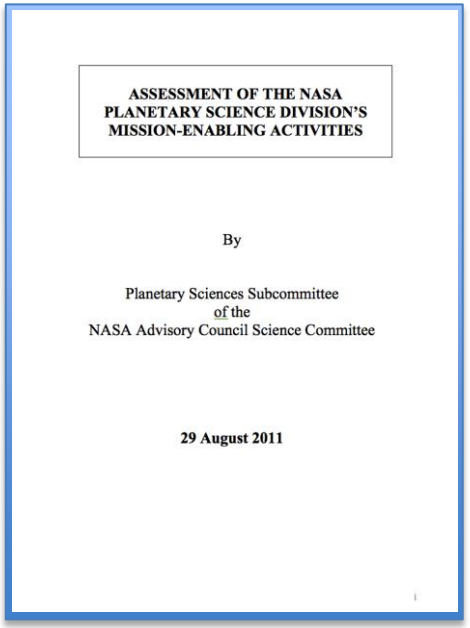
Guiding Documents



Fisk Report - 2010



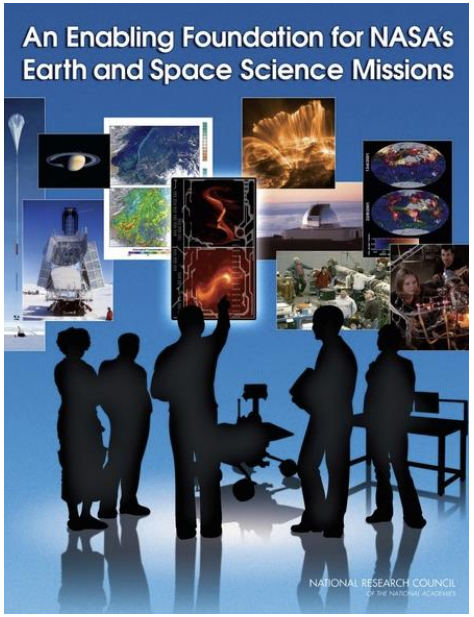
Planetary Decadal - 2011



Greeley Report - 2011

AN ENABLING FOUNDATION FOR NASA'S SPACE AND EARTH SCIENCE MISSIONS

Fisk Report - 2010



Findings from the NRC report: An Enabling Foundation for NASA's Earth and Space Science Missions (2010)

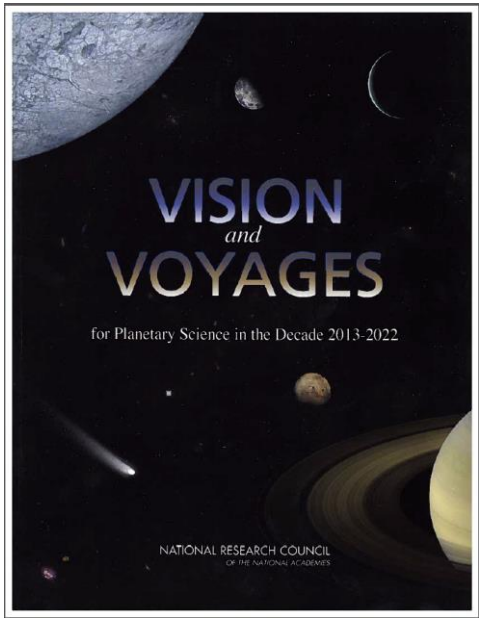
1. NASA should ensure that SMD mission-enabling activities are linked to the strategic goals of the agency and of SMD.
2. NASA's SMD should develop and implement an approach to actively managing its portfolio of mission-enabling activities.
3. NASA should increase the number of scientifically and technically capable program officers so that they can devote an appropriate level of attention to the tasks of actively managing the portfolio of research…

NASA response was in agreement with these recommendations: "By *explicitly* tying the ROSES solicitations…to the SMD Science Plan research objectives, SMD ensures that sponsored research contributes directly and substantially to Agency goals."

1. PSD reorganized its ROSES elements such that they *explicitly* tie to the SMD Science Plan research objectives
2. PSD actively manages the R&A Program – keeping the PSS and community appraised as to the changes
3. PSD has augmented its civil servant staff with contractor and IPA scientists

VISION AND VOYAGERS FOR PLANETARY SCIENCE
IN THE DECADE 2013-2022

R&A Recommendations From the Decadal Survey



V&V Research and Analysis Program

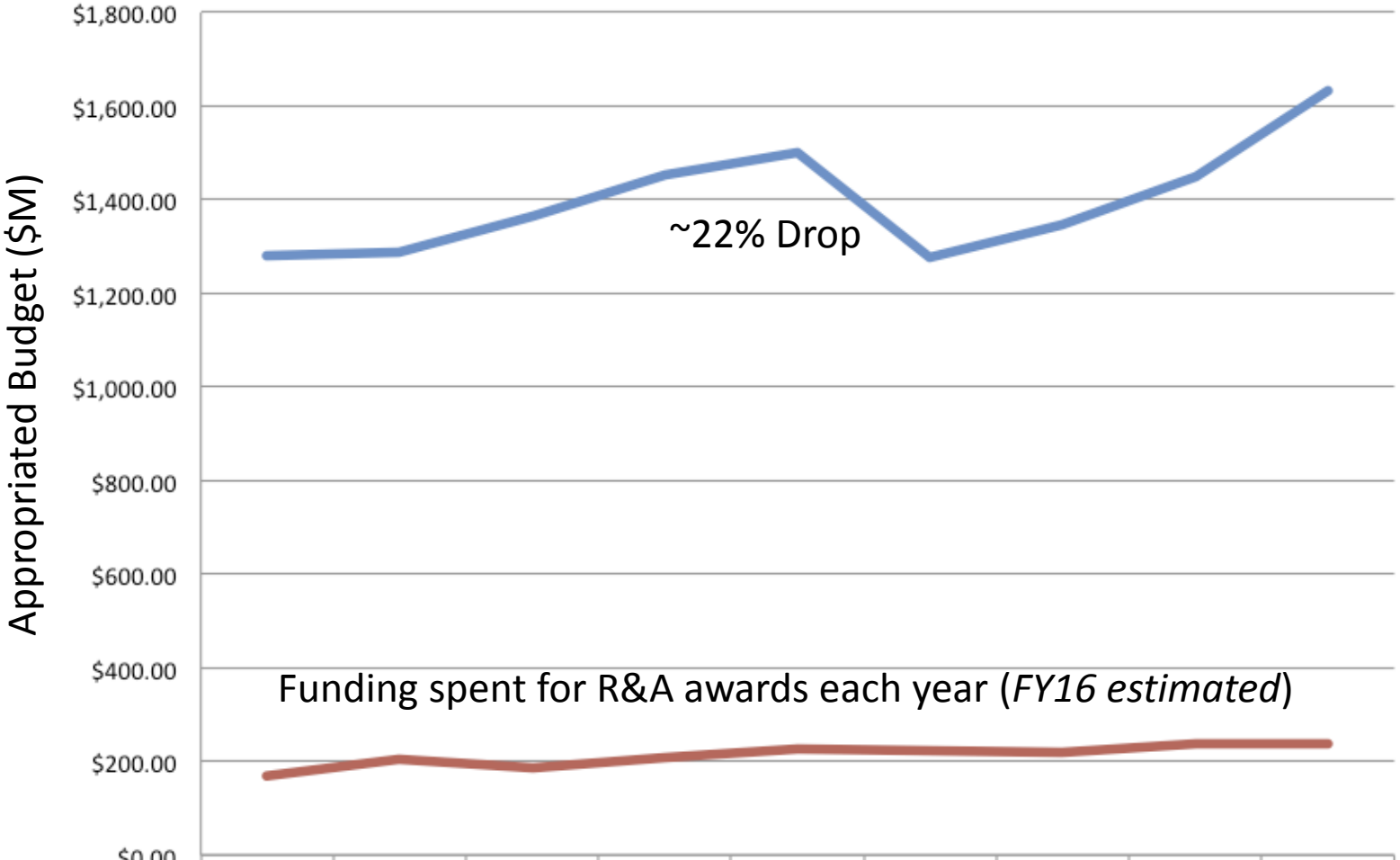
1. Increase the NASA planetary R&A budget by 5% above the total finally approved FY2011 expenditures in the first year, and then by 1.5% above inflation each successive year. p.285 (J. Green)

2. Seek ways (e.g., by merging related research programs and lengthening award periods) to increase average grant sizes and reduce the number of proposals that must be written, submitted, and reviewed by the community. p.285 (J. Rall)

3. The committee recommends that the Planetary Science Division's technology program should accept the responsibility, and assign the required funds, to continue the development of the most important technology items through TRL 6. p.305 (J. Green)

   – Instrument technology development is part of the R&A program solicited through ROSES program calls

Planetary Science Total + R&A Budget



FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
$1,280.30	$1,288.10	$1,364.40	$1,451.00	$1,500.00	$1,275.00	$1,345.00	$1,450.00	$1,631.00
$169.00	$204.00	$188.00	$208.00	$227.00	$222.00	$218.00	$237.00	$239.00

Instrument Technology Program Evolution

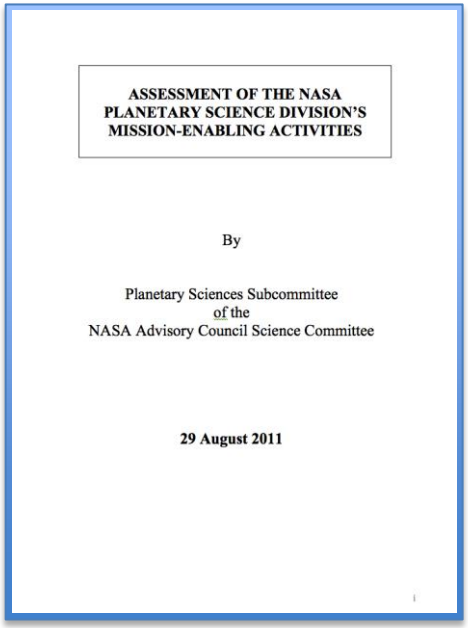
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mars Instrument Development Project										
Planetary Instrument Definition and Development										
Astrobiology Science and Technology Instrument Development, including Concept Studies for Small Payloads and Satellites										
Maturation of Instruments for Solar System Exploration										
Planetary Inst Concepts for Advancement of Solar System Observations										
Instrument Concepts for Europa Exploration										
Small, Innovative Missions for Planetary Exploration										
New Frontiers Homesteader										
Concepts for Ocean worlds Life Detection Technology (COLDTech)										

- PICASSO – Low TRL instrument development
- MatISSE – Mid-TRL instrument development

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Astrobiology Science and Technology for Exploring Planets										
Moon and Mars Analogue Mission Activities (with HEO)										
Planetary Science and Technology Through Analog Research										

- Instrument field testing also supported

PLANETARY SCIENCE SUBCOMMITTEE SUPPORTING RESEARCH AND TECHNOLOGY WORKING GROUP
Greeley Report - 2011



ASSESSMENT OF THE NASA PLANETARY SCIENCE DIVISION'S MISSION-ENABLING ACTIVITIES

By

Planetary Sciences Subcommittee
of the
NASA Advisory Council Science Committee

29 August 2011

PSS Chartered Working Group

- PSD requested the PSS to establish a working group to respond to the Fisk Report recommendations
- Supporting Research & Technology (SRT) WG - Terms of Reference:
  1. Identify mission-enabling, research and analysis activities that are required to support the strategic goals of the SMD Planetary Science Division (PSD);
  2. Map these activities onto existing PSD program elements and identify activities that overlap multiple elements and activities unsupported by any element;
  3. Provide recommendations to PSD regarding the application of “active portfolio management” to meet its strategic goals.

SR&T WG Key Results

- 13 Recommendations were provided in the Greeley report
- Most recommendations were in the area of "portfolio management"

"…The SR&T Working Group found that the current Planetary Science Division mission-enabling activities can be mapped clearly to the specific scientific objectives contained in the NASA 2010 Science Plan. However, many of the research and analysis programs overlap. Because the workload on the scientific community and NASA Program officers has increased substantially in the last decade with regard to proposal preparation, review, and implementation, the Planetary Science Division should consider consolidating programs to eliminate overlap as a part of the portfolio management strategy… "

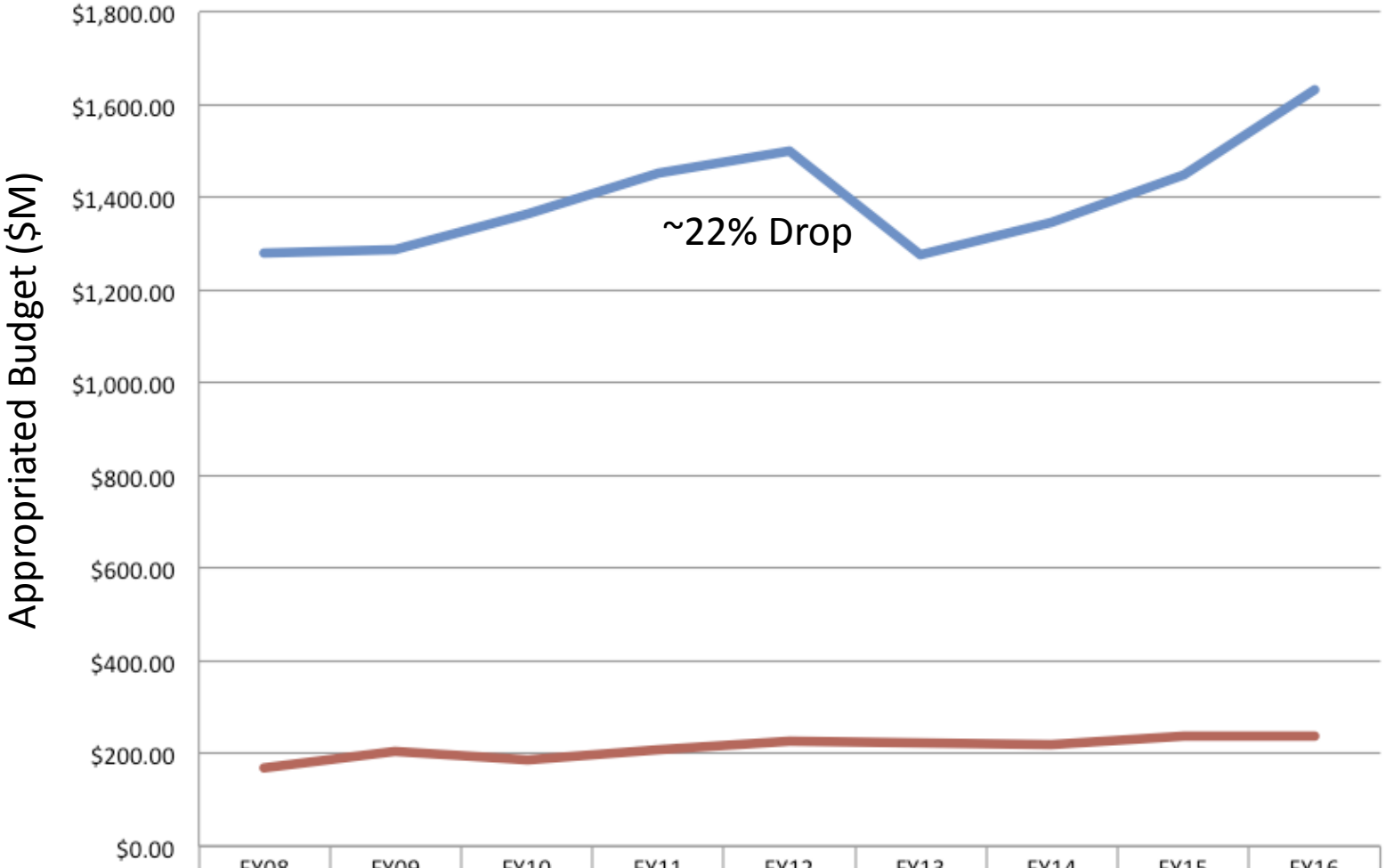
Greely Report, Executive Summary, August, 29, 2011, P.1

Greeley Report Recommendations

1. Recommendation: NASA should increase the research and analysis *budget* for planetary science by 5 percent above the total finally approved FY2011 expenditures in the first year of the coming decade, and increase the budget by 1.5 percent above the inflation level for each successive year of the decade. . . . Funding for the R&A program should not be diluted by adding significant new responsibilities. Such new responsibilities added to the R&A program should be accompanied by the additional funds needed to support it."

Response: From FY13-FY15 the Planetary Science Division's Budget was at levels below the FY12 budget. During this time period it was not possible to increase the R&A budget but it did remain the same.

Planetary Science Total + R&A Budget



FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
$1,280.30	$1,288.10	$1,364.40	$1,451.00	$1,500.00	$1,275.00	$1,345.00	$1,450.00	$1,631.00
$169.00	$204.00	$188.00	$208.00	$227.00	$222.00	$218.00	$237.00	$239.00

Greeley Report Recommendations

2. Recommendation: The PSD should consider implementing division-wide coordination and evaluation of the mission-enabling activities by NASA and the community by holding a *"Senior Review"* at least every 10 years, which could be linked to the NRC Surveys.

Response: As required by the administration and Congress, the PSD's R&A program is reviewed annually in the GPRAMA and SOAR reviews. In addition, R&A is also a major topic in the Planetary Decadal and Midterm review by the NRC (now NAS).

Government Performance and Results Act Modernization Act (GPRAMA)

The Government Performance and Results Act Modernization Act (GPRAMA) of 2010, P.L. 111-352, provides a framework for NASA's performance planning and reporting activities covering the 2014-2018 timeframe.

On an annual basis:

1. PSD coordinates assessment of progress on each of the Planetary Science Science Goals
   - Draft assessment developed by PSD and reviewed and rated by the Planetary Science Subcommittee (PSS)
2. For each goal a color-coded ranking assigned (Green, Yellow, Red)
3. NASA's complete Annual Performance Report is submitted to Congress after the end of each Fiscal Year and posted on nasa.gov for public access.

FY15 Annual Performance Metrics for PSD

- Demonstrate progress in advancing the understanding of how the chemical and physical processes in the solar system operate, interact and evolve. (PG 1.5.1: PS-15-1) **GREEN**
- Demonstrate progress in exploring and observing the objects in the solar system to understand how they formed and evolve. (PG 1.5.2: PS-15-2) **GREEN**
- Demonstrate progress in exploring and finding locations where life could have existed or could exist today. (PG 1.5.3: PS-15-3) **GREEN**
- Demonstrate progress in improving understanding of the origin and evolution of life on Earth to guide the search for life elsewhere. (PG 1.5.4: PS-15-4) **GREEN**
- Demonstrate progress in identifying and characterizing objects in the solar system that pose threats to Earth or offer resources for human exploration. (PG 1.5.5: PS-15-9) **GREEN**

Color	Guidelines
GREEN	Expectations for the research program fully met in context of resources invested.
YELLOW	Some notable or significant shortfalls, but some worthy scientific advancements achieved.
RED	Major disappointments or shortfalls in scientific outcomes, uncompensated by other unusually positive results.

- From FY12 to FY15, PSD annual performance has been rated as **GREEN**

SOAR: Introduction and Requirements

- Strategic Objective Annual Review or SOAR
  - An annual assessment of each Strategic Objective, analyzing progress toward NASA's strategic direction
  - Required by Congress and implemented by OMB for all major Federal agencies
  - NASA looks at four methodological elements: long-term **impact**, **implementation**, strategic **risks & challenges**, and **opportunities**
- OMB uses this information to understand Agency plans, evaluate an Agency's budget, and take action where appropriate
- Compulsory categorization of all 15 NASA Objectives
  - Categories:

- Procedure: PSD performs a self-assessment, concurrent with an independent Agency review. The Agency's proposed ratings are submitted to OMB, with OMB's final ratings and report subsequently provided to Congress.

Strategic Review Rating Trends

Strategic Objective	2014	2015	2016
1.1, Human exploration	Satisfactory	Satisfactory	
1.2, ISS	Satisfactory	Noteworthy	
1.3, Commercial spaceflight	Satisfactory	Satisfactory	
1.4, Heliophysics	Noteworthy	Noteworthy	
1.5, Planetary	Noteworthy	Noteworthy	
1.6, Astrophysics	Satisfactory	Satisfactory	
1.7, STMD	Satisfactory	Satisfactory	*Agency review conducted*
2.1, Aeronautics	Satisfactory	Satisfactory	*April 29, 2016;*
2.2, Earth Science	Satisfactory	Noteworthy	*OMB review to follow.*
2.3, OCT	Satisfactory	Satisfactory	
2.4, Education	Satisfactory	Focus Area	
3.1, Mission Support	Focus Area	Focus Area	
3.2, Tech capabilities	Focus Area	Focus Area	
3.3, IT Services	Satisfactory	Focus Area	
3.4, SMS	Satisfactory	Satisfactory	

Greeley Report Recommendations

3. Recommendation: PSD should establish its own balanced *mission-enabling technology* program and make available substantial, stable funding through the competed process to develop technology and scientific instruments for flight qualification (TRL ~6).

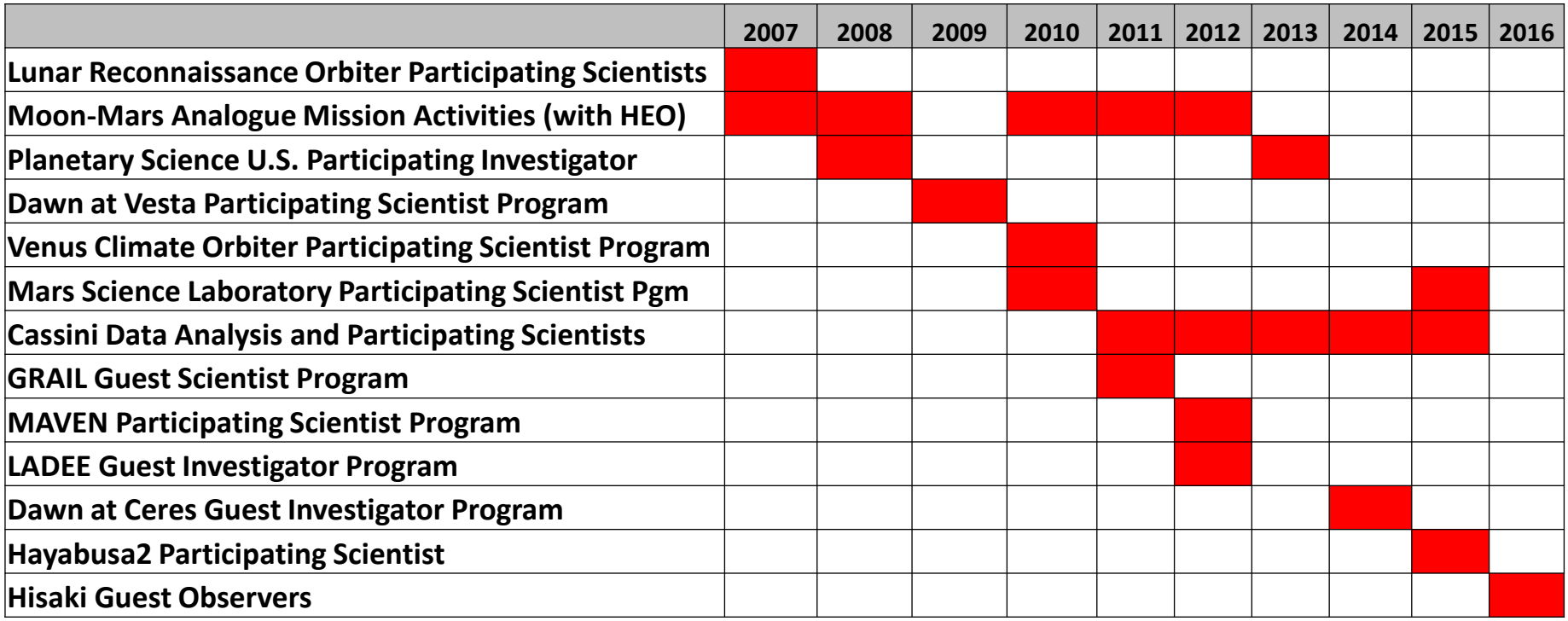
Response:

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mars Instrument Development Project										
Planetary Instrument Definition and Development										
Astrobiology Science and Technology Instrument Development, including Concept Studies for Small Payloads and Satellites										
Maturation of Instruments for Solar System Exploration										
Planetary Inst Concepts for Advancement of Solar System Obs										
Instrument Concepts for Europa Exploration										
Small, Innovative Missions for Planetary Exploration										
New Frontiers Homesteader										
Concepts for Ocean worlds Life Detection Technology (COLDTech)										

Greeley Report Recommendations

4. Recommendation: Establish a uniform policy and procedure for ensuring healthy *turnover in science team membership* on long duration projects and for augmenting mission science teams.

Response: Participating scientist programs are designed to augment mission science teams with the needed experience.



Planetary Science Subcommittee Findings And Recommendations

5. Recommendation: PSD should consider establishing specific *criteria for evaluating the success of each activity* in meeting the stated purpose of the activity. Since program elements consist of several areas of such activities identified in their AOs, this might in part consist of first stating how each area supports a PSD strategic objective or objectives and to identify metrics by which one decides that the objective is advanced by that area. These might be qualitative. The metrics are then applied against the activities funded over the previous year. In order to minimize the burden on the program officer, investigators might be tasked with applying these metrics to their funded activities in their annual and final reports, to then be collated by the program officer.

Response: By reorganizing the R&A program explicitly support PSD Goals & Objectives GPRAMA and SOAR evaluations provide a direct evaluation of progress.

	2012	2013	2014	2015	2016
GPRAMA	GREEN	GREEN	GREEN	GREEN	GREEN
SOAR			Noteworthy Progress	Noteworthy Progress	**TBD**

Planetary Science Subcommittee Findings And Recommendations

6. Recommendation:
Pressure on the proposal process may be ameliorated by increasing grant size and grant duration up to 5 years if fully justified and applied relatively uniformly to PSD programs (reviewers would need to “adjust” thinking to accept this), however, such a recommendation should not be implemented without modeling the effects of such changes, including their potential impact on the workforce; consideration should also be given to reducing overlap among programs.

Response: J. Rall

Planetary Science Subcommittee Findings And Recommendations

7. Recommendations:

1) Program Officers are encouraged to *communicate* with their communities more frequently, either directly or through vehicles such as the *Planetary Exploration Newsletter* (PEN) and the NASA *Service and Advice for Research and Analysis* (SARA) website and
2) A table should be published annually by PSD giving the *approximate dates* when all Division review panels will meet and when proposers should expect the award selections to be announced.

Response:

1) PSD management continues to communicate with the community:
   2013: December 3, 2013: Virtual Town Hall on R&A Restructuring
   2014 Mid-January: Draft ROSES 2014 release for comment
   2014 Mid-February: ROSES 2014 release
   2014 Early to Mid-March: Pre-proposal Briefing
   Periodic meetings include:
      Annual R&A Town Halls at LPSC, DPS, AGU
      R&A Status Update at PSS (3 times/year)
2) PSD Strives to make selections with 180 days

Planetary Science Subcommittee Findings And Recommendations

***8. Recommendation**:* The following *statement* should be included in the announcement of the program "Well-justified proposals for significantly greater than average budgets could be considered for funding."

***9. Recommendation**:* The Division should establish *standard instructions* that are given to all review panels, which would include a statement of the "charge" to the panels that is uniform and include instructions to the panel to be as specific as possible on the summary review forms with regard to major and minor weaknesses.

***10. Recommendation**:* The letter from the Program Officer should include a section that explains the *justification for the shorter duration*.

***11. Recommendations**:*

1) Solicitation of qualified *panelists and reviewers* should be made routinely by the Division Director through announcements, such as in PEN,
2) Senior graduate students can serve as *Executive Secretaries*, but they should not serve as reviewers,
3) Application of *conflict of interest* standards on reviewers need to take into consideration whether simple means of mitigation could be applied that would allow the expansion of the pool of reviewers (e.g., allowing co-Investigators to serve on a review panel, but leave the room when their proposal is under consideration).

Response to 8-11: Aspects of these Recommendations have been implemented.

Planetary Science Subcommittee Findings And Recommendations

12. Recommendation*:* The current policy of *notification* no later than six months from the proposal due date and one month from the meeting of the review panel should be followed.

Response: This is now a standard practice

13. Recommendation*:* PSD needs to consider the establishment of a well-coordinated and integrated program for development of the next generation *of laboratory instruments* to be used in sample characterization and analysis. In addition, the NASA's advisory group for returned samples (CAPTEM) should be involved in the early planning phases of sample return missions to plan for appropriate collection, characterization (including containment and hazard assessment, if required), curation, handling and allocation of returned materials.

Response: PSD accomplishes this through:

1. Planetary Major Equipment Program (PME) – an annual call for laboratory instruments
2. PSS/PSD is currently conducting a survey on Planetary laboratory capabilities and support
3. CAPTEM has been involved with OSIRIS-REx and Mars 2020 at an early stage
4. Standard A.O. requires all proposals to include a sample curation plan

Questions?